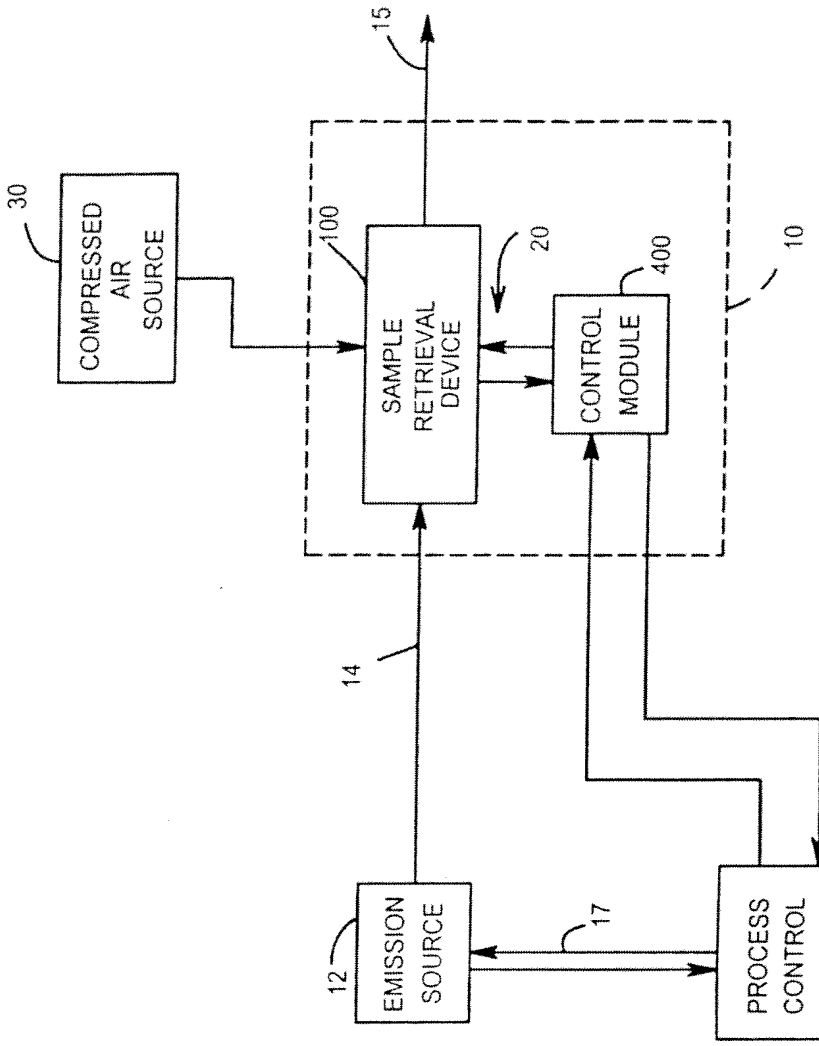
15
30
COMPRESSED AIR SOURCE
100
SAMPLE RETRIEVAL DEVICE
20
400
CONTROL MODULE
10
14
12
EMISSION SOURCE
17
PROCESS CONTROL SYSTEM
40

FIGURE 1A

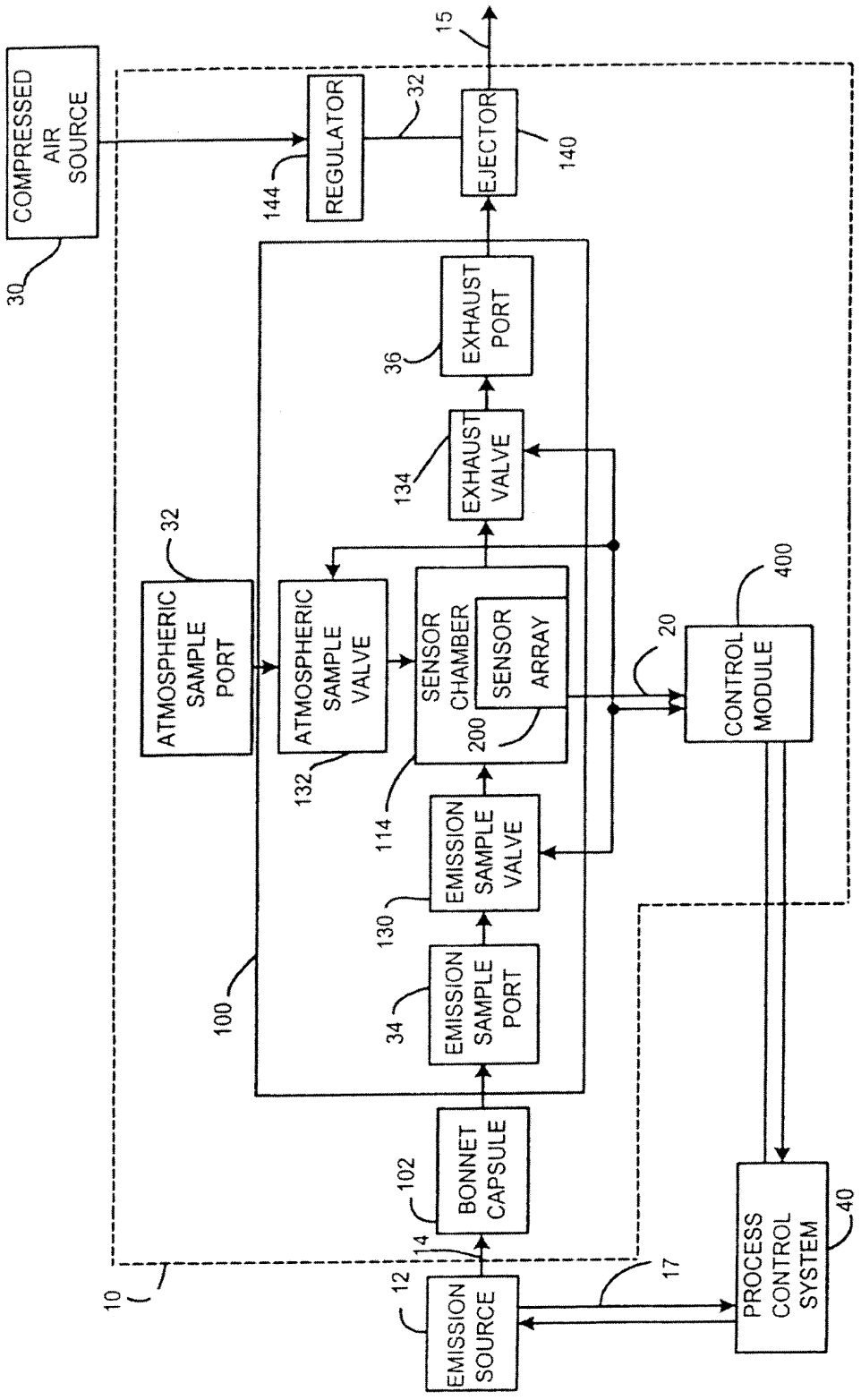
COMPRESSED AIR SOURCE
30
REGULATOR
144
32
EJECTOR
140
15
EXHAUST PORT
36
EXHAUST VALVE
134
ATMOSPHERIC SAMPLE PORT
32
ATMOSPHERIC SAMPLE VALVE
132
SENSOR CHAMBER
SENSOR ARRAY
200
CONTROL MODULE
400
20
100
EMISSION SAMPLE VALVE
130
114
EMISSION SAMPLE PORT
34
BONNET CAPSULE
102
14
12
EMISSION SOURCE
10
17
PROCESS CONTROL SYSTEM
40

FIGURE 1B

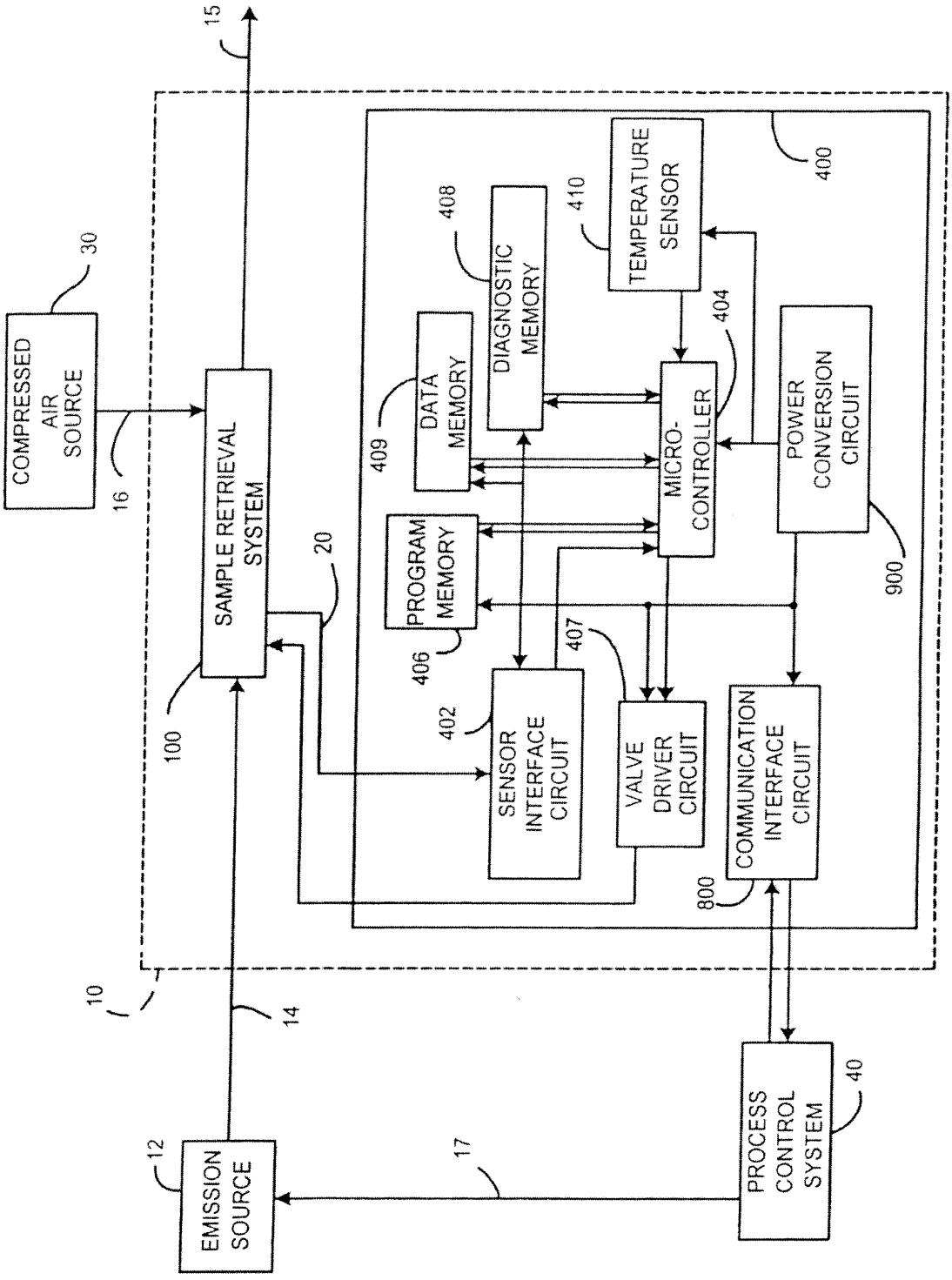
COMPRESSED AIR SOURCE
30
16
SAMPLE RETRIEVAL SYSTEM
15
20
100
10
14
EMISSION SOURCE
12
17
PROCESS CONTROL SYSTEM
40
400
DATA MEMORY
409
DIAGNOSTIC MEMORY
408
TEMPERATURE SENSOR
410
MICRO-CONTROLLER
404
POWER CONVERSION CIRCUIT
900
PROGRAM MEMORY
406
SENSOR INTERFACE CIRCUIT
402
VALVE DRIVER CIRCUIT
407
COMMUNICATION INTERFACE CIRCUIT
800

FIGURE 1C

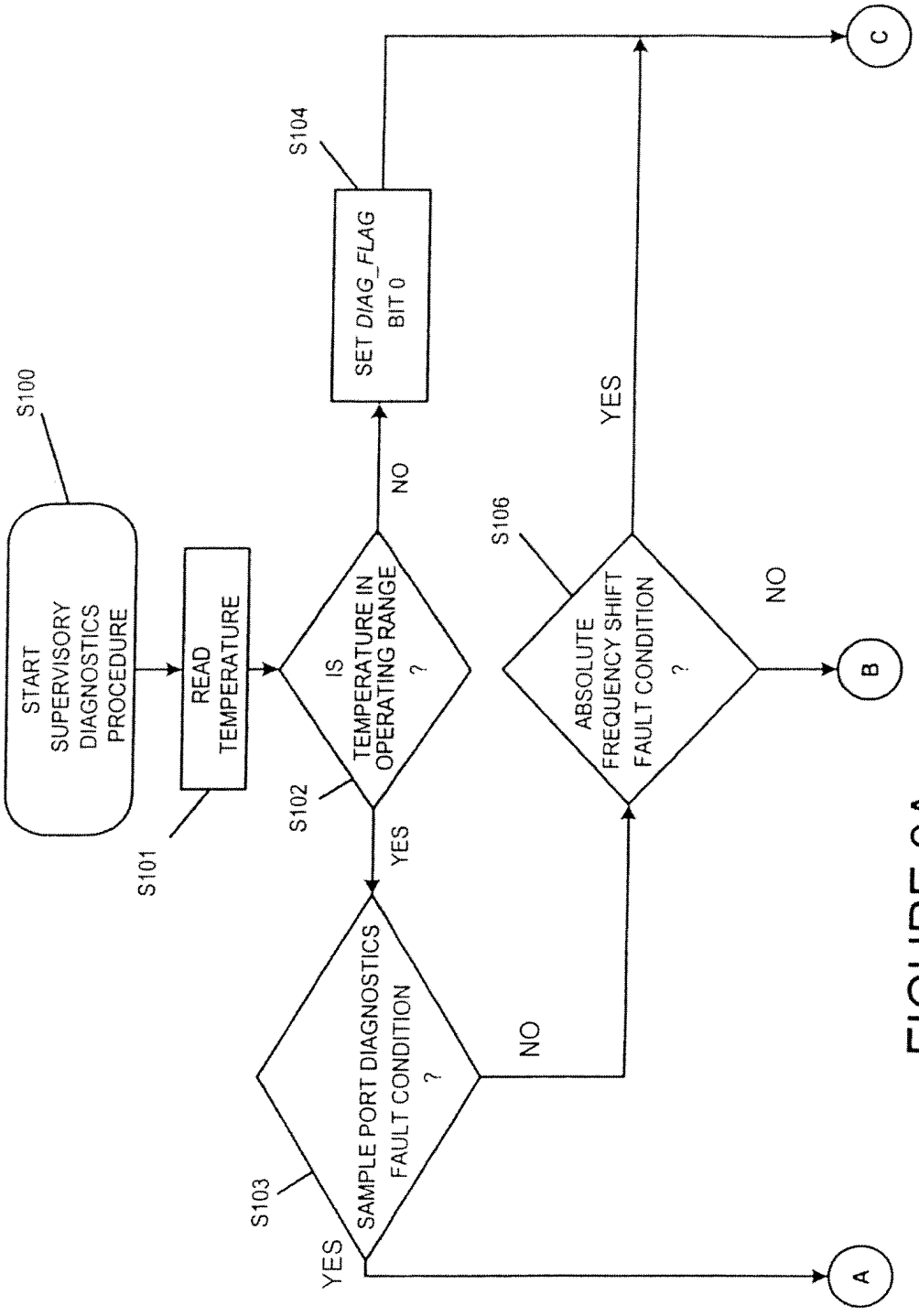
START SUPERVISORY DIAGNOSTICS PROCEDURE
S100
READ TEMPERATURE
S101
IS TEMPERATURE IN OPERATING RANGE ?
S102
NO
SET DIAG_FLAG BIT 0
S104
YES
SAMPLE PORT DIAGNOSTICS FAULT CONDITION ?
S103
YES
NO
ABSOLUTE FREQUENCY SHIFT FAULT CONDITION ?
S106
YES
NO
A
B
C

FIGURE 2A

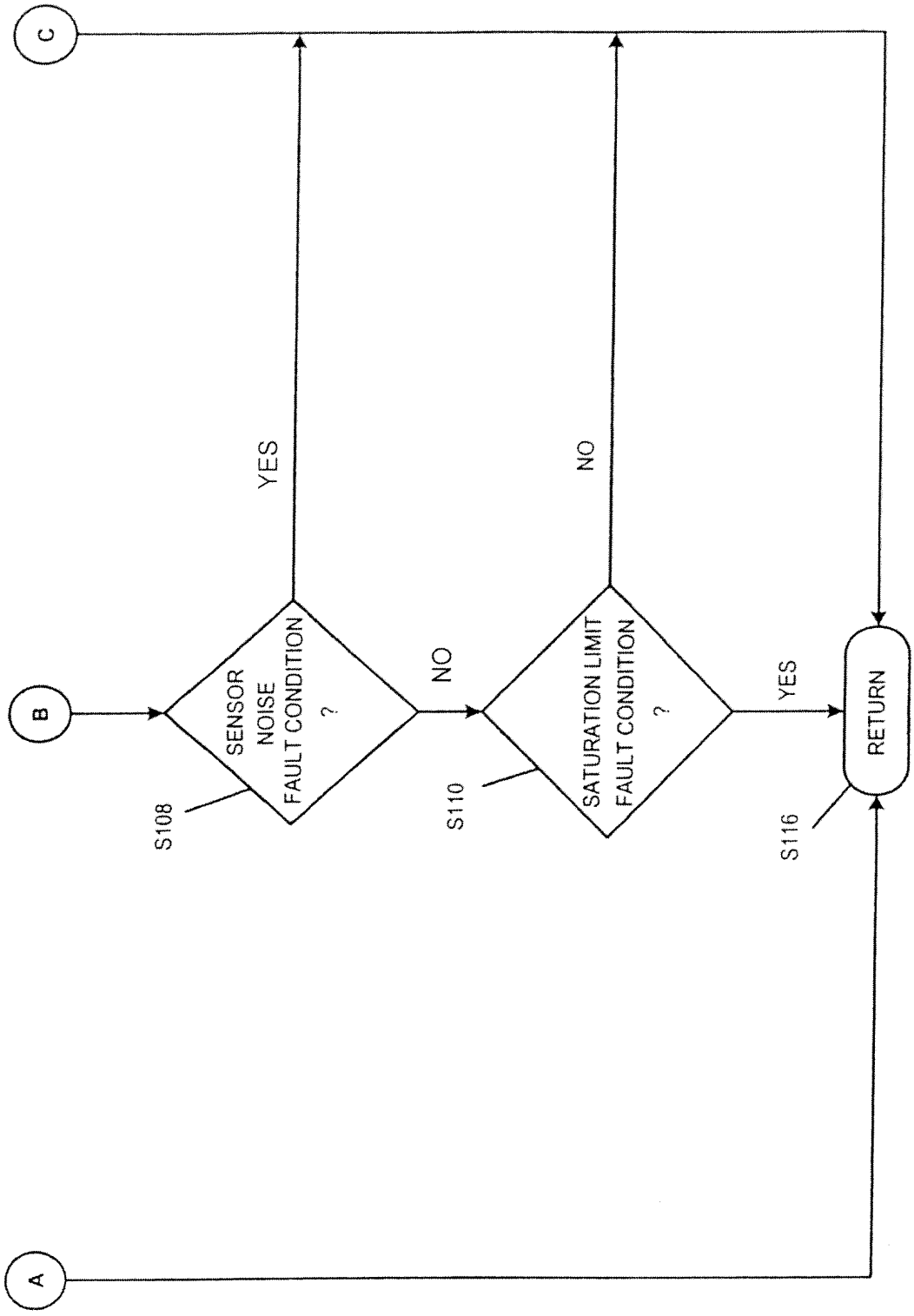
A
B
C
SENSOR NOISE FAULT CONDITION ?
S108
YES
NO
SATURATION LIMIT FAULT CONDITION ?
S110
NO
YES
RETURN
S116

FIGURE 2B

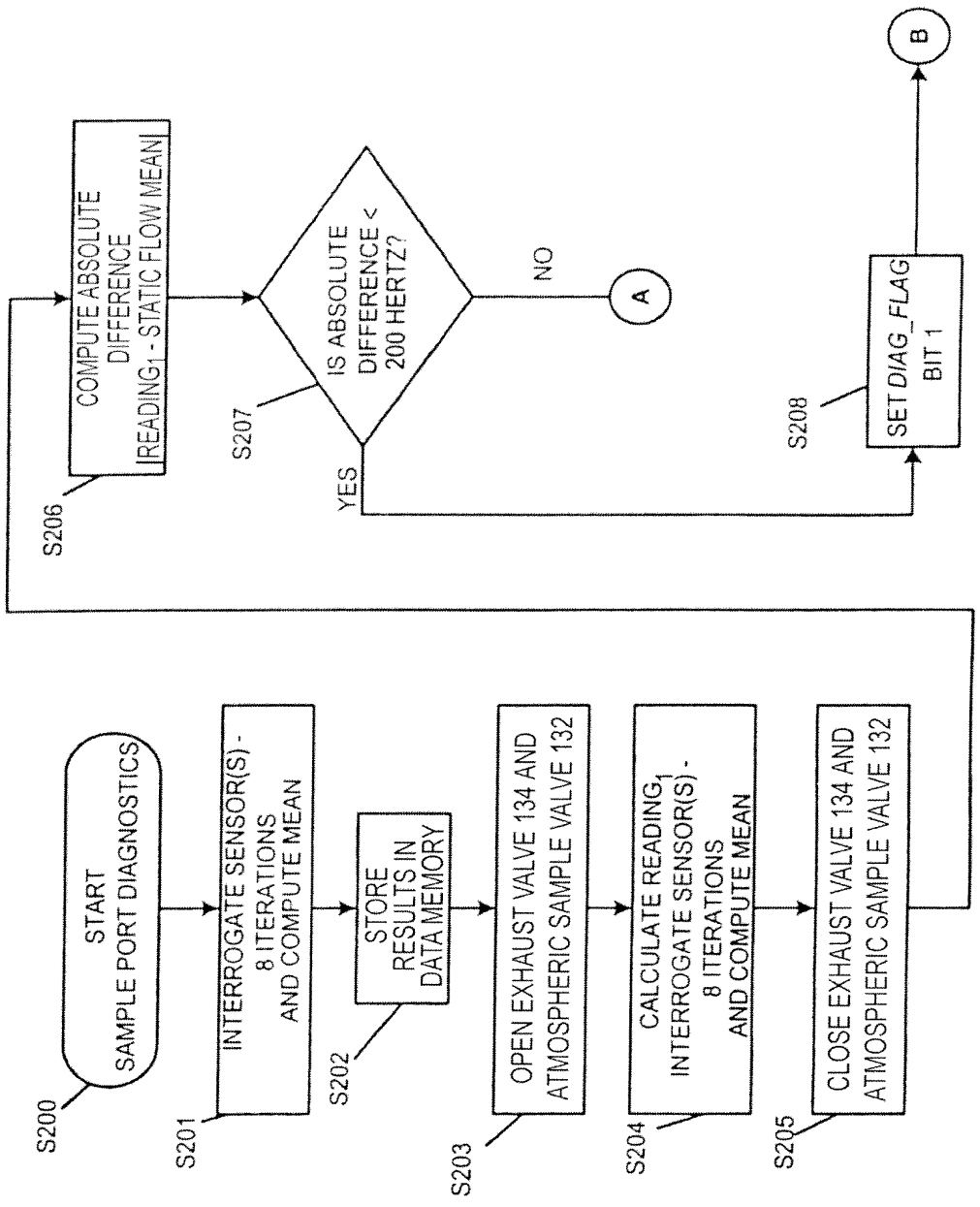
START
SAMPLE PORT DIAGNOSTICS
S200
INTERROGATE SENSOR(S) - 8 ITERATIONS AND COMPUTE MEAN
S201
STORE RESULTS IN DATA MEMORY
S202
OPEN EXHAUST VALVE 134 AND ATMOSPHERIC SAMPLE VALVE 132
S203
CALCULATE READING1 INTERROGATE SENSOR(S) - 8 ITERATIONS AND COMPUTE MEAN
S204
CLOSE EXHAUST VALVE 134 AND ATMOSPHERIC SAMPLE VALVE 132
S205
COMPUTE ABSOLUTE DIFFERENCE |READING1 - STATIC FLOW MEAN|
S206
IS ABSOLUTE DIFFERENCE < 200 HERTZ?
S207
YES
NO
A
SET DIAG_FLAG BIT 1
S208
B

FIGURE 3A

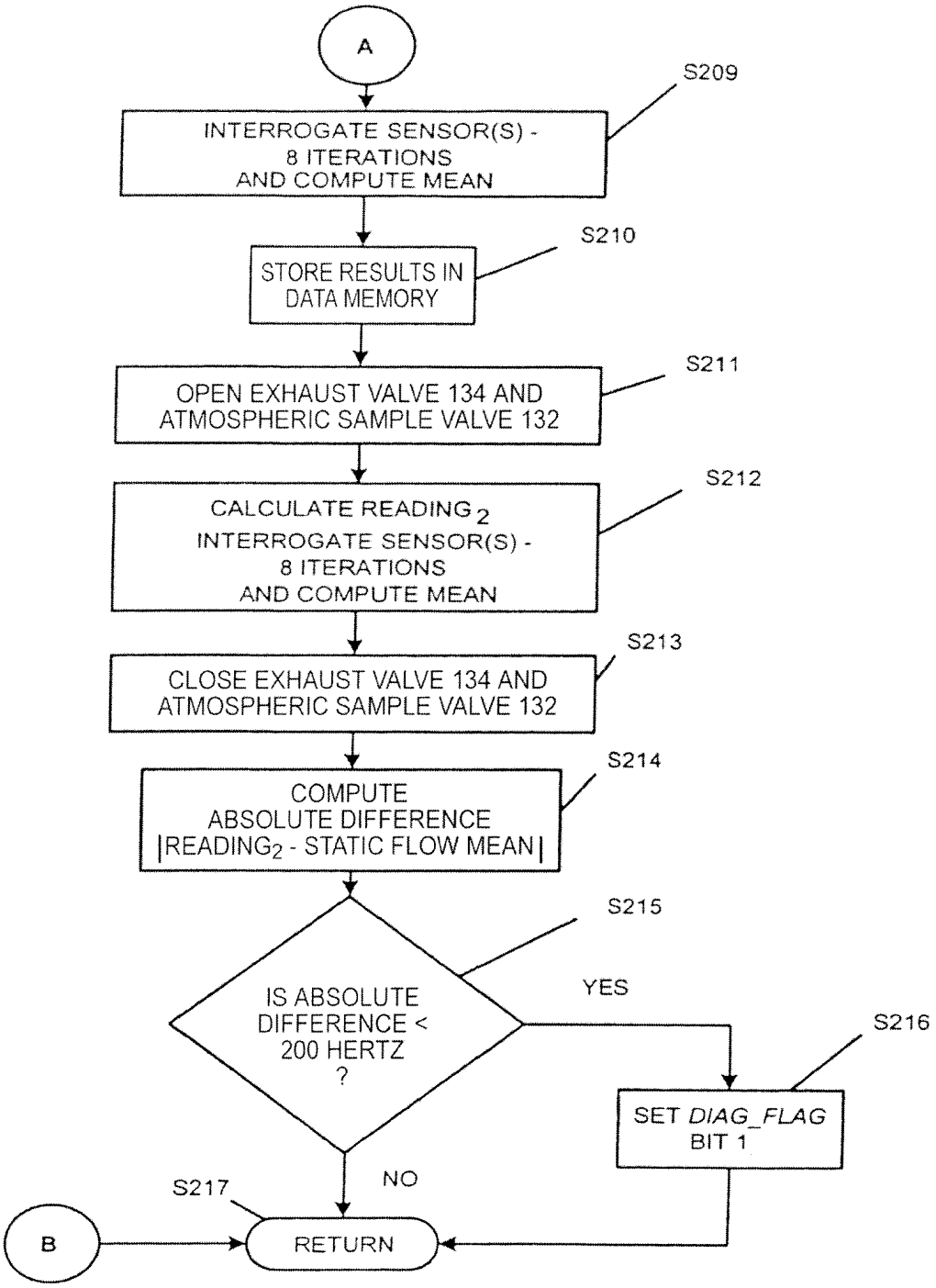
A
S209
INTERROGATE SENSOR(S) - 8 ITERATIONS AND COMPUTE MEAN
S210
STORE RESULTS IN DATA MEMORY
S211
OPEN EXHAUST VALVE 134 AND ATMOSPHERIC SAMPLE VALVE 132
S212
CALCULATE READING 2
INTERROGATE SENSOR(S) - 8 ITERATIONS AND COMPUTE MEAN
S213
CLOSE EXHAUST VALVE 134 AND ATMOSPHERIC SAMPLE VALVE 132
S214
COMPUTE ABSOLUTE DIFFERENCE |READING2 - STATIC FLOW MEAN|
S215
IS ABSOLUTE DIFFERENCE < 200 HERTZ ?
YES
S216
SET DIAG_FLAG BIT 1
NO
S217
B
RETURN

FIGURE 3B

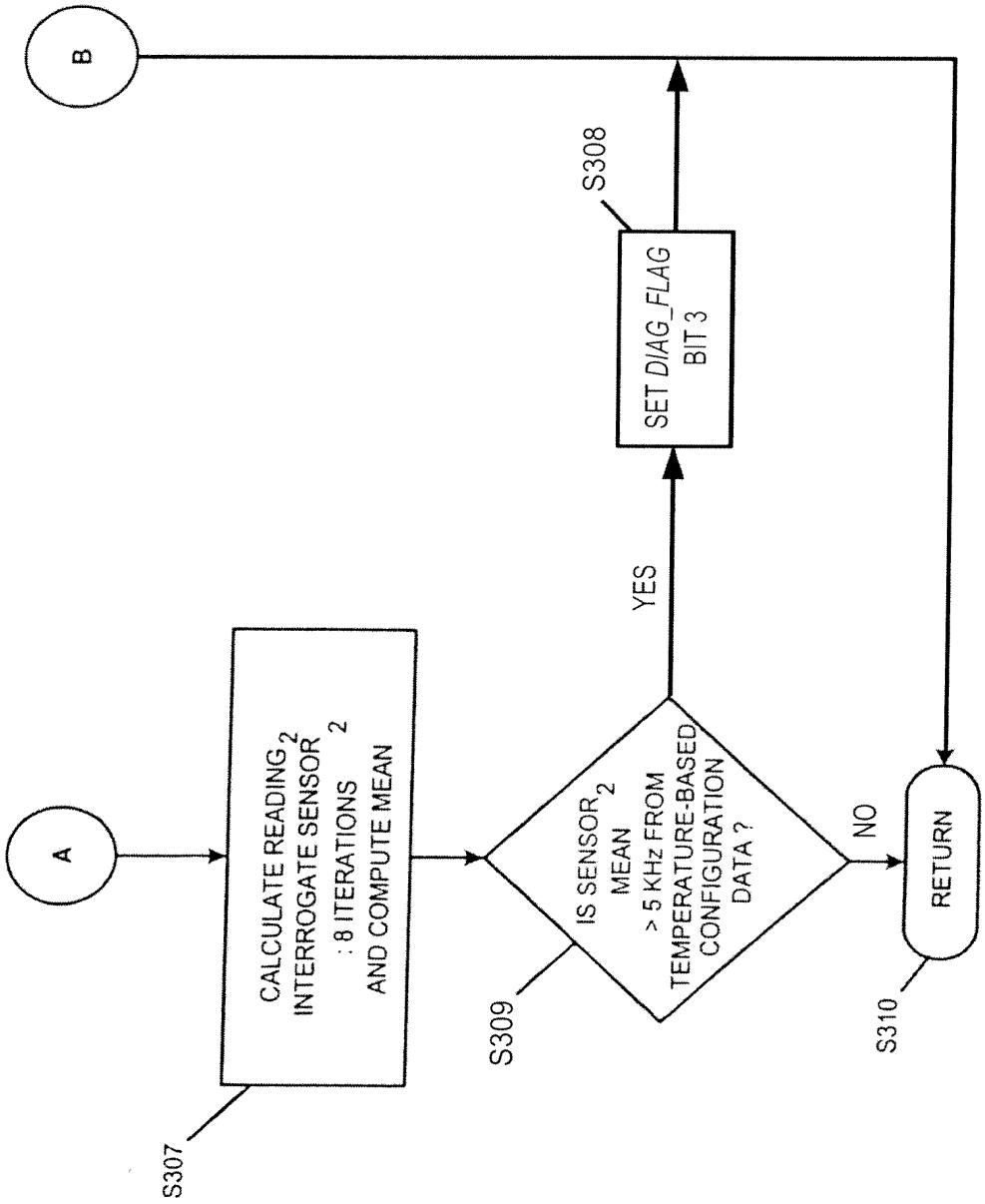
A
B
CALCULATE READING $_2$ INTERROGATE SENSOR ^{2} : 8 ITERATIONS AND COMPUTE MEAN
S307
IS SENSOR $_2$ MEAN > 5 KHz FROM TEMPERATURE-BASED CONFIGURATION DATA ?
S309
YES
NO
SET DIAG_FLAG BIT 3
S308
RETURN
S310

FIGURE 4B

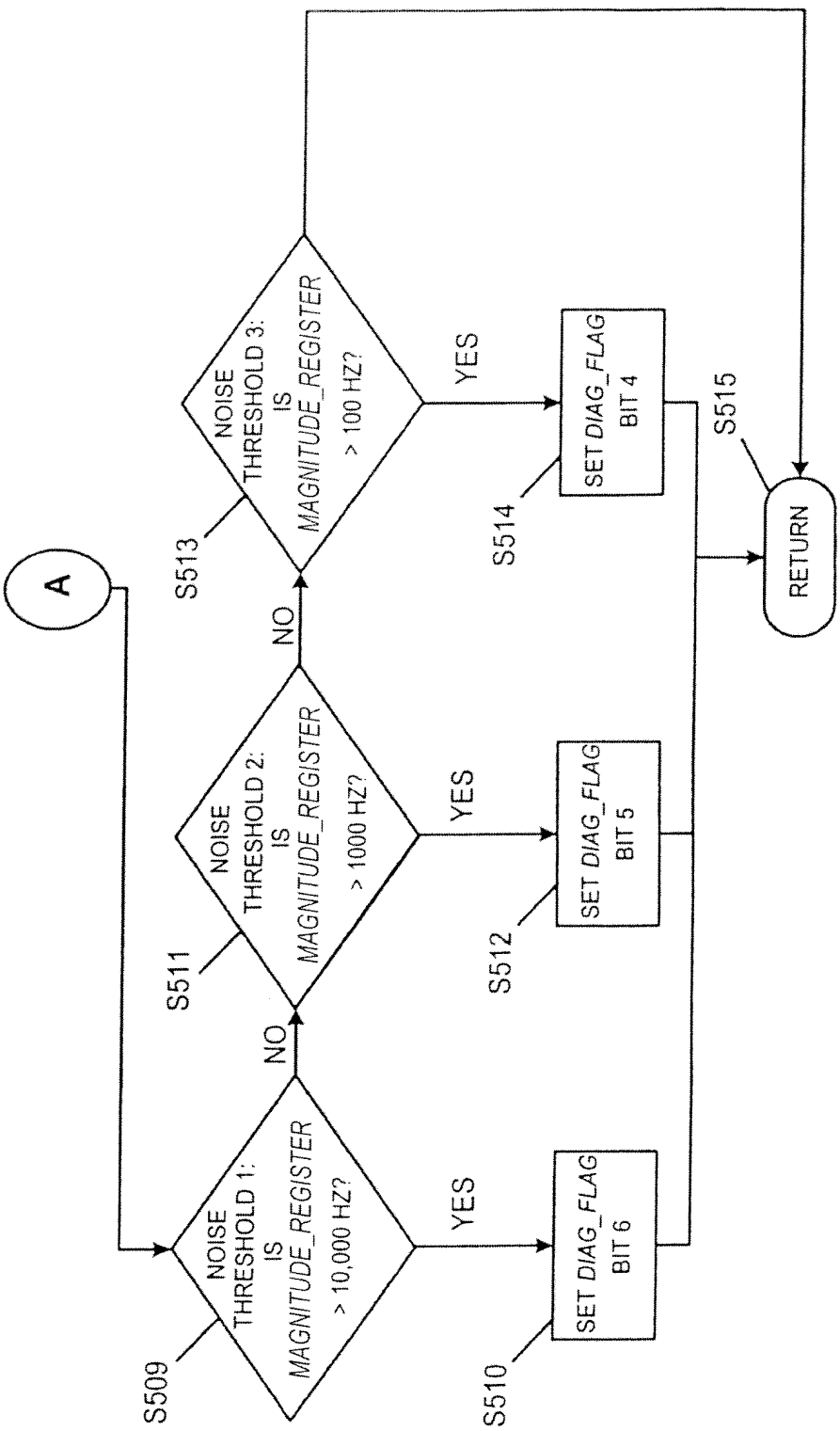
A
S509
NOISE THRESHOLD 1: IS MAGNITUDE_REGISTER > 10,000 HZ?
YES
S510
SET DIAG_FLAG BIT 6
NO
S511
NOISE THRESHOLD 2: IS MAGNITUDE_REGISTER > 1000 HZ?
YES
S512
SET DIAG_FLAG BIT 5
NO
S513
NOISE THRESHOLD 3: IS MAGNITUDE_REGISTER > 100 HZ?
YES
S514
SET DIAG_FLAG BIT 4
S515
RETURN

FIGURE 5B

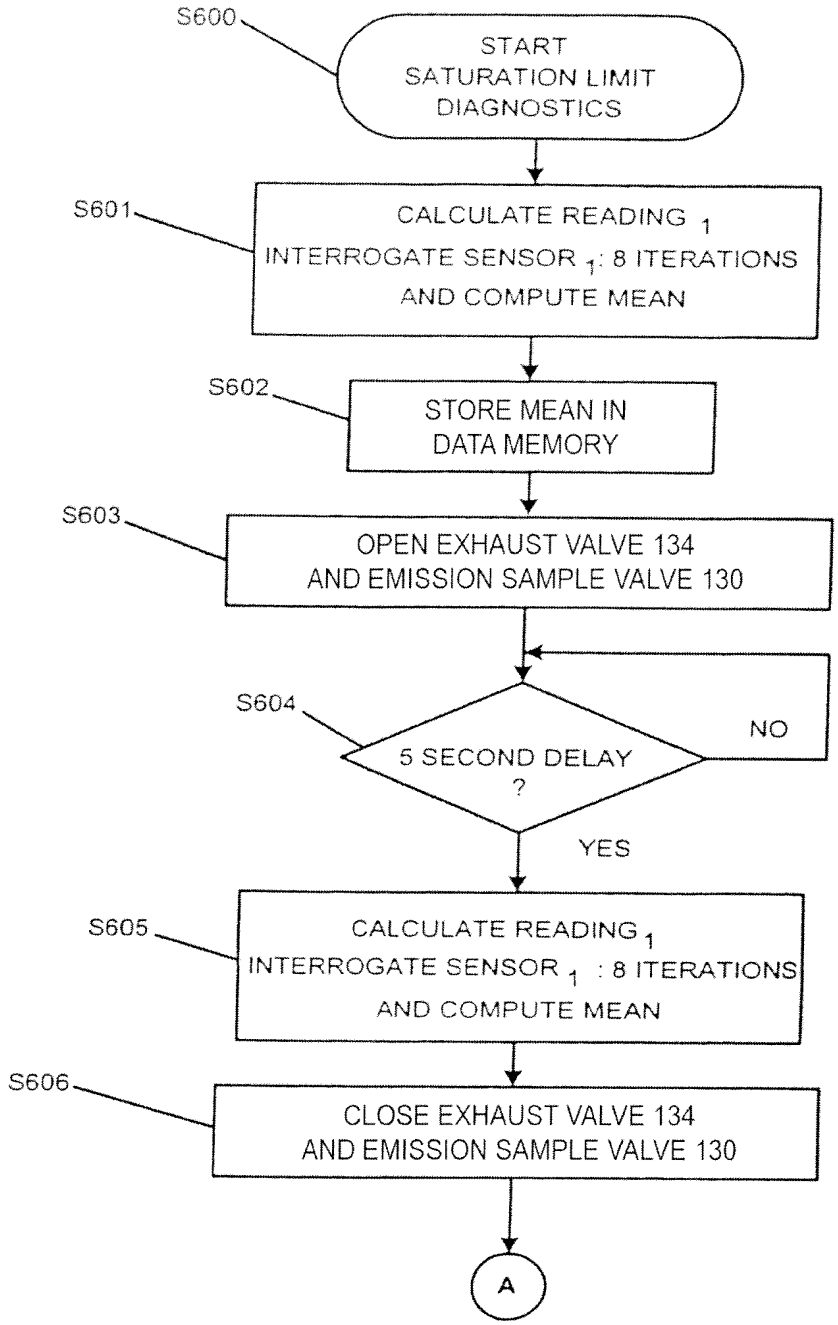
S600
START
SATURATION LIMIT
DIAGNOSTICS
S601
CALCULATE READING 1
INTERROGATE SENSOR 1: 8 ITERATIONS
AND COMPUTE MEAN
S602
STORE MEAN IN
DATA MEMORY
S603
OPEN EXHAUST VALVE 134
AND EMISSION SAMPLE VALVE 130
S604
5 SECOND DELAY
?
NO
YES
S605
CALCULATE READING 1
INTERROGATE SENSOR 1 : 8 ITERATIONS
AND COMPUTE MEAN
S606
CLOSE EXHAUST VALVE 134
AND EMISSION SAMPLE VALVE 130
A

FIGURE 6A

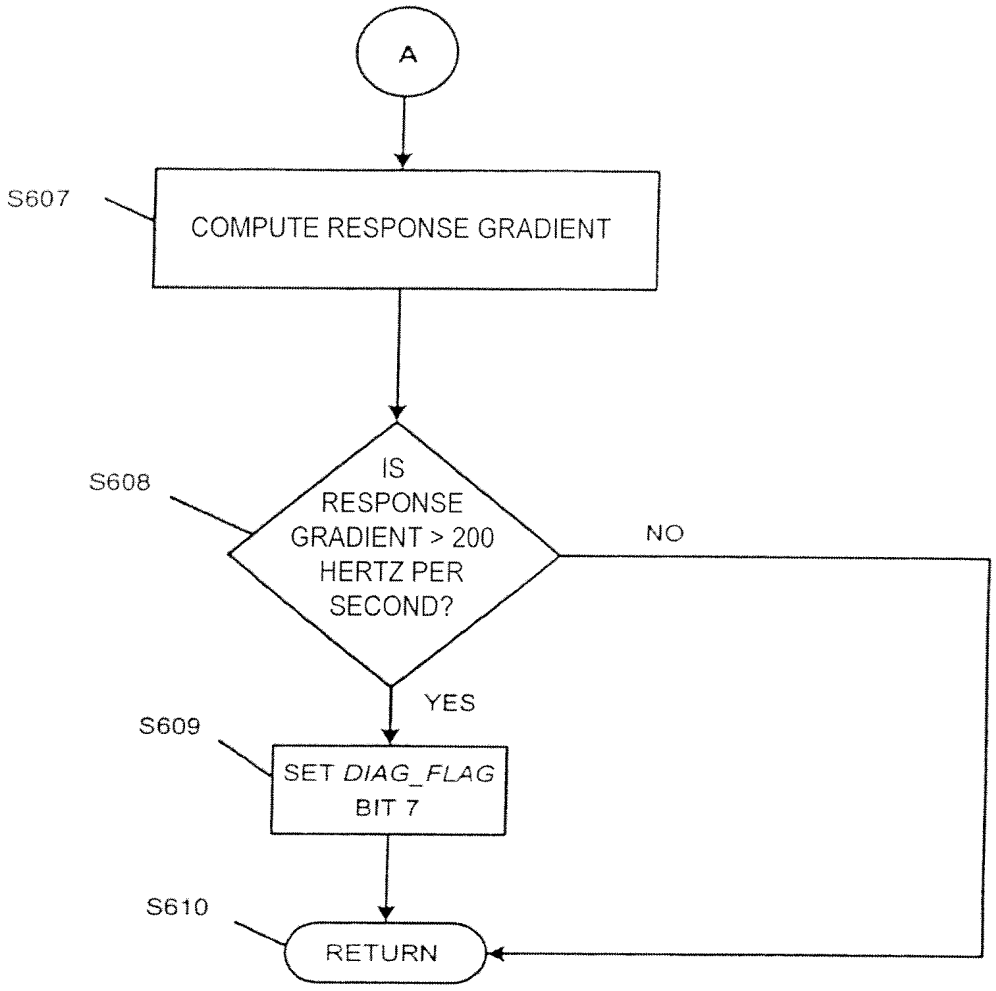
A
S607
COMPUTE RESPONSE GRADIENT
S608
IS RESPONSE GRADIENT > 200 HERTZ PER SECOND?
NO
YES
S609
SET DIAG_FLAG BIT 7
S610
RETURN

FIGURE 6B